Towards a functional continuum operating system

IoT2Cloud Operating System
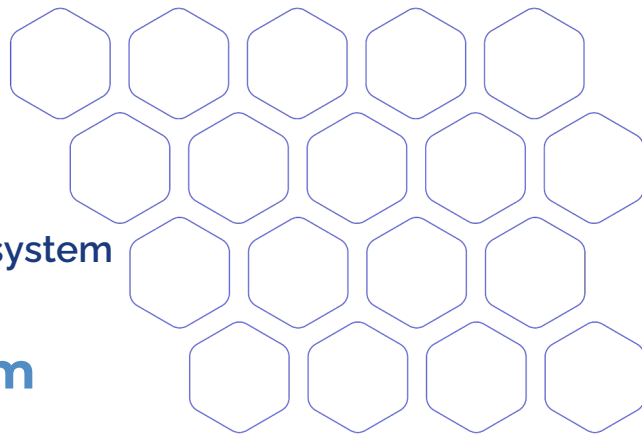
Elena Japundžić

FundingBox
#FundingChampions

Funded by
the European Union

November 2023

About the project

ICOS = IoT2Cloud Operating System

Topic: HORIZON-CL4-2021-DATA-01-05: Future European platforms for the Edge: Meta Operating Systems (RIA).

Main objective: to design, develop and validate **a meta operating system** for a continuum.

How? By extending existing platforms and creating a platform where not only **cloud computing resources are managed** but also **edge/IoT devices are integrated.**

Railway Structural Alert Monitoring System
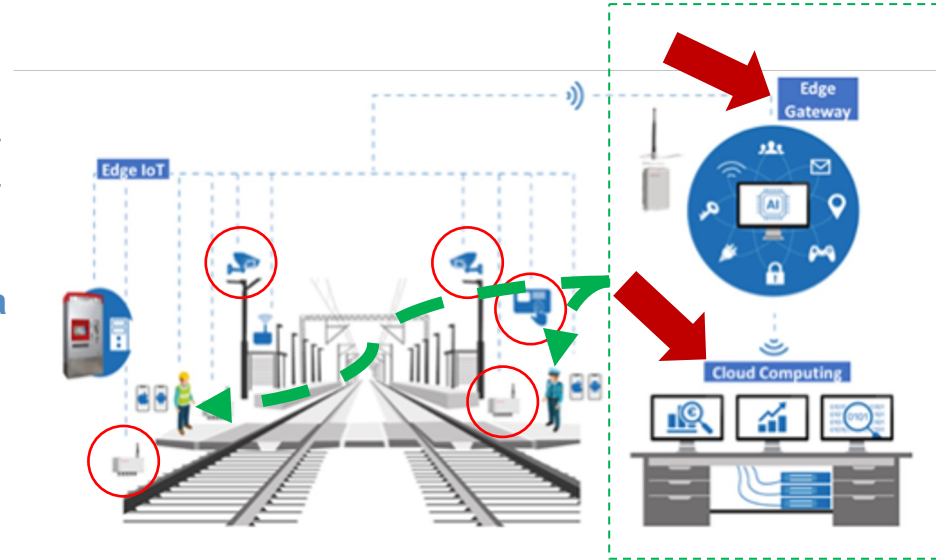
ICOS

Objectives

1. Design of an intelligent meta OS for the continuum

2. Exploiting novel intelligent data and resource utilization methods

3. Enforce trustworthy yet open operation

4. Demonstrate the project outcomes in key relevant scenarios (use cases)

5. Building an open innovation environment and fostering the creation of new applications in the continuum as well as the science and engineering community

ICOS

FundingBox
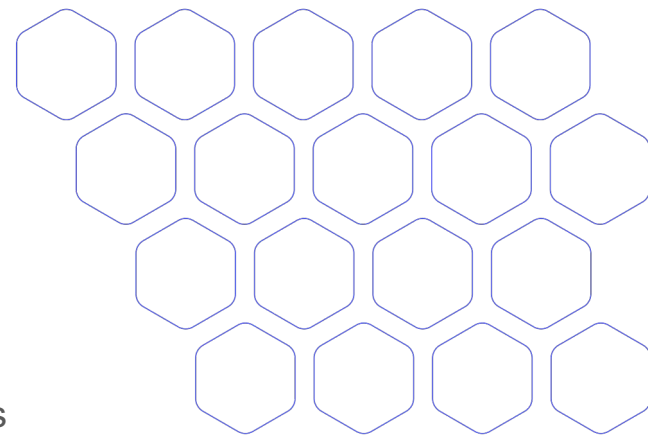
ICOS

Challenges to be addressed:
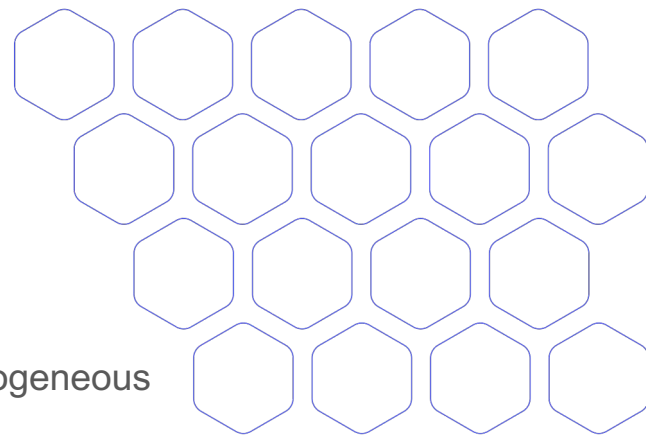
1. Enabling a device and technology agnostic operation in a heterogeneous continuum infrastructure.

2. Facilitating an on-demand ad-hoc and AI-assisted development of the continuum infrastructure

3. Considering reliability and trust-by-design

4. Creating an open platform facilitating resources, models, data and services sharing promoting EU innovation and new business models in the continuum arena.

ICOS PILOT Use Cases

## In-car Advanced Infotainment and Multimedia Management system (IAIMM)
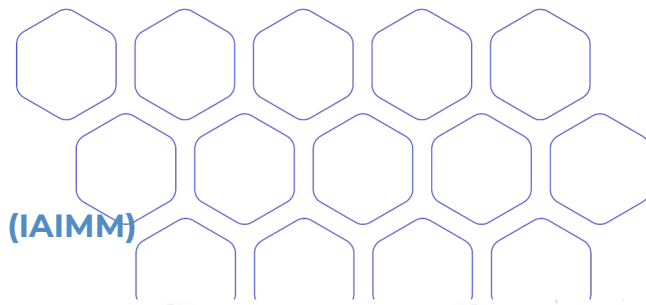
CONCEPT:

Multi-users and Multi-sites Virtual Sharing Experience to interact in sync with high-definition media contents (3D models, immersive videos, pictures, etc.) with in-car passengers and other users far away. The service provides and enriches multimedia functionalities for planning, enjoying trips and visiting touristic sites. Its deployment architecture includes edge nodes to host rendering and preprocessing and more powerful cloud nodes.

BENEFITS:

Ensure seamless user experience by optimizing the distribution of multimedia content and maintaining high levels of quality of service (QoS) and quality of experience (QoE) also in case of low connectivity. Provide secure multiuser communication and interaction infrastructure able to ensure privacy and security of shared data
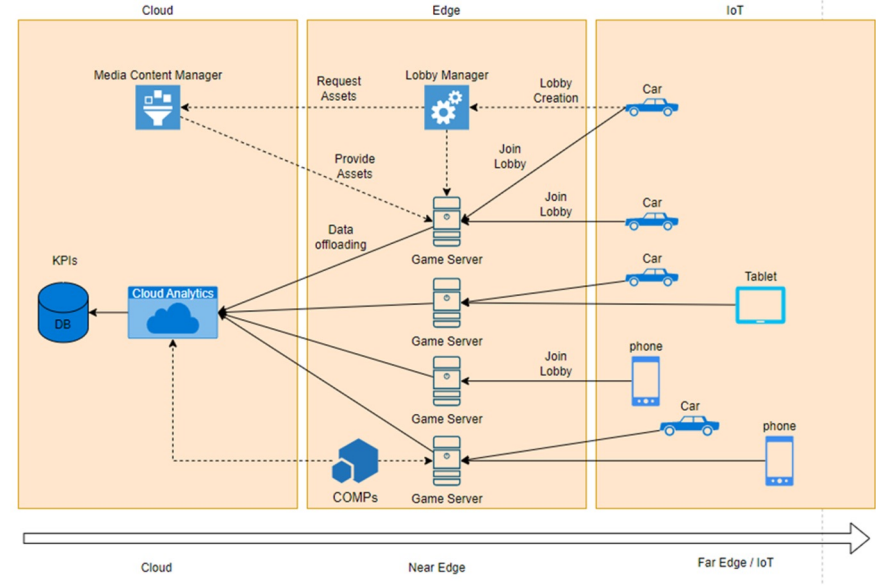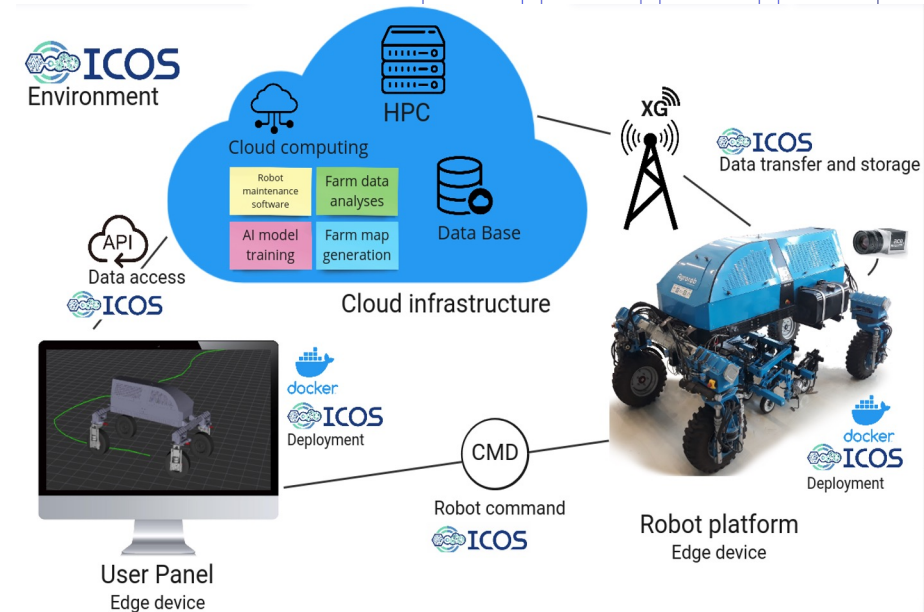
ICOS PILOT Use Cases

Agriculture Operational Robotic Platform (AORP)

CONCEPT:

Further development of digital and robotic systems based on data exchange ecosystems and services based on their semantic processing to provide knowledge and tools that will increase efficiency, ensure safety, and confirm product quality in the supply chain, while reducing costs and providing valuable and up to date information to farmers.

BENEFITS:

Optimizes farming with agro robots (Agbots). Agbots are used for precision agriculture to develop processes on farms **reducing operating costs, improving awareness of technology potential impact, digital competences, improves effective use of resources as well as reduces the amount of used plant protection products.**

ICOS PILOT Use Cases

Railway Structural Alert Monitoring system (RSAM)

CONCEPT:

The main challenge to be addressed by the use case is related to the continuous monitoring of critical infrastructure on rail tracks to ensure safety and improve maintenance activities.

The railway line along an area select for the use case is where communications are limited in availability and bandwidth. META OS will make it possible to benefit from processing at the edge while sharing limited amounts of extremely relevant information to the upper layers of other applications.

BENEFITS:

- Time saving through continuous monitoring: limit intensive personnel inspections that are done every day before trains circulations.
- Cost saving: implement corrective actions in advance to avoid reparation costs.
- Improve safety: establish velocity limits to avoid risky situations with quality of the operation decrease.
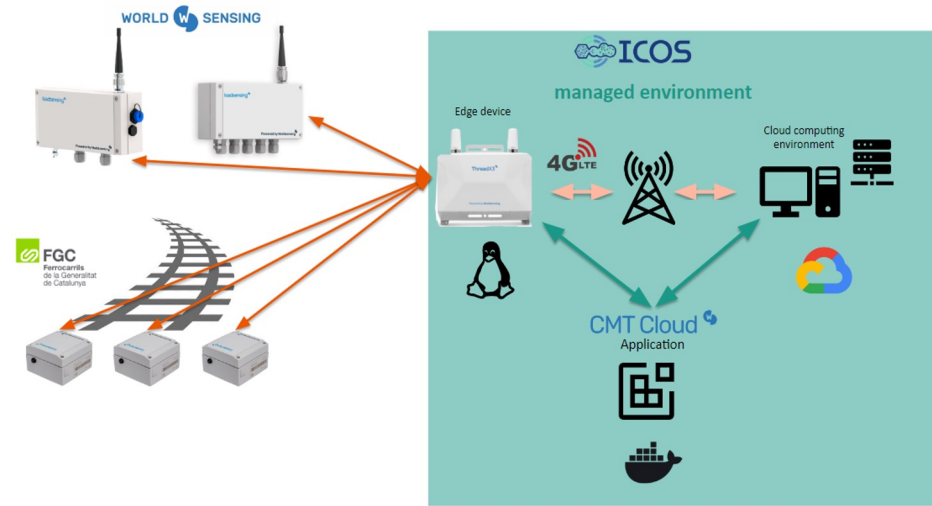
ICOS PILOT Use Cases

Energy Management and Decision Support system (EMDS)

CONCEPT:

ICOS EMDS system aims to deliver a secure and efficient energy system, based on advanced and reliable Machine Learning techniques for energy forecasting and home-to-home parameters sharing to avail of learnings obtained in other houses. The ICOS AI 'brain' will shape the future usage of the Prosumers with the aim of flattening the demand curve by removing demand on the grid at peak time and boosting energy usage at night-time.

BENEFITS:

Thanks to ICOS, the application will be able to leverage Cloud and Edge capabilities for real time solutions, with latency reduction, increased security and flexibility to tailor to customers' specific needs, using automated decisions to decrease costs, reduce generation curtailment, maximise consumption and usage of renewable energy, increasing client satisfaction and retention.
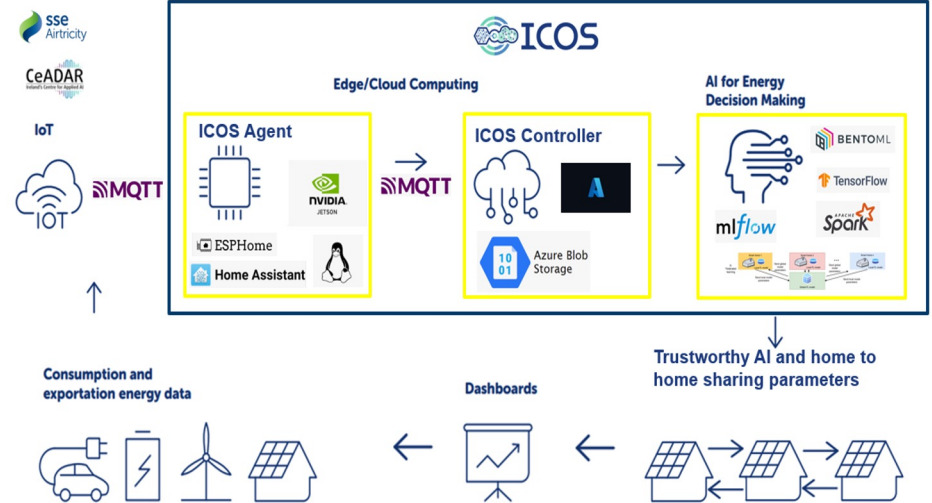
ICOS

Architecture

Dynamic metaOS distributed along the continuum.

Cloud (virtually unlimited computing and storage capacity, ubiquity) **vs.** the Edge (locality exploitation, latency and communication reduction, privacy preservation)

Nodes can join/leave, move throughout the continuum, establishing new proximity-based relationships between other nodes in different geographic locations
2 types of nodes:
the **Agents** (that execute the users' workloads)
the **Controllers** (responsible for managing the agents)
+   a 'Lighthouse' to simplify and automate the dynamic on-boarding of ICOS Agents to ICOS Controllers.
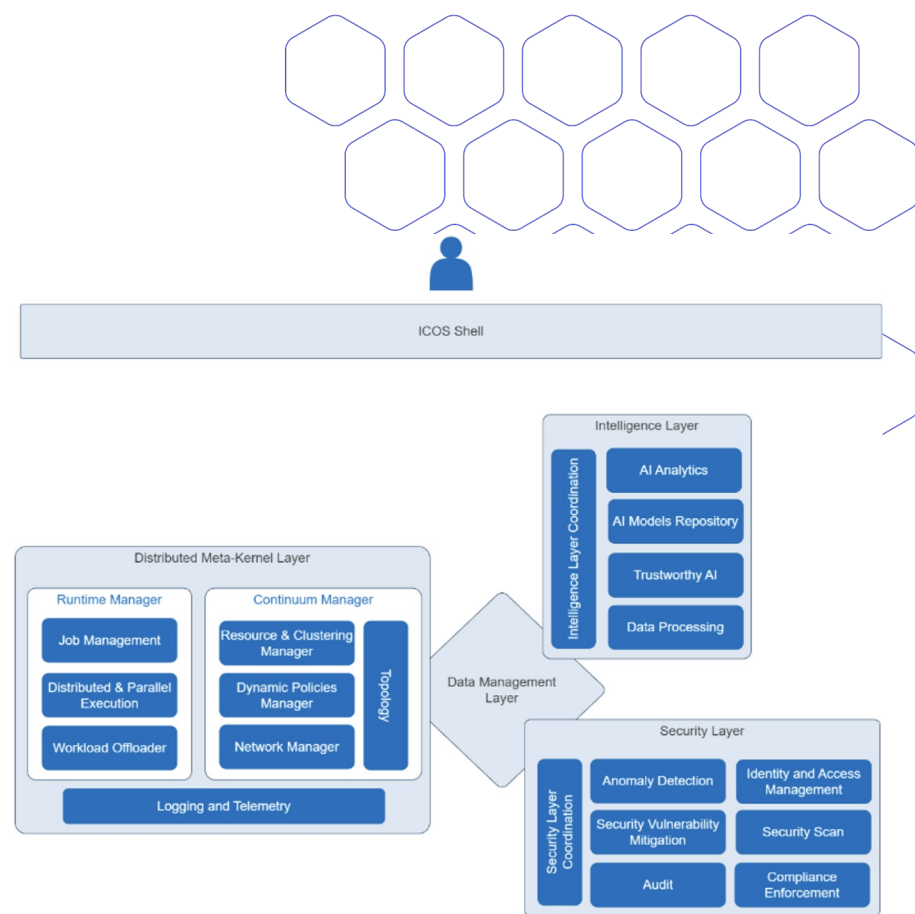

: ICOS Controller

: ICOS Agent

ICOS Lighthouse
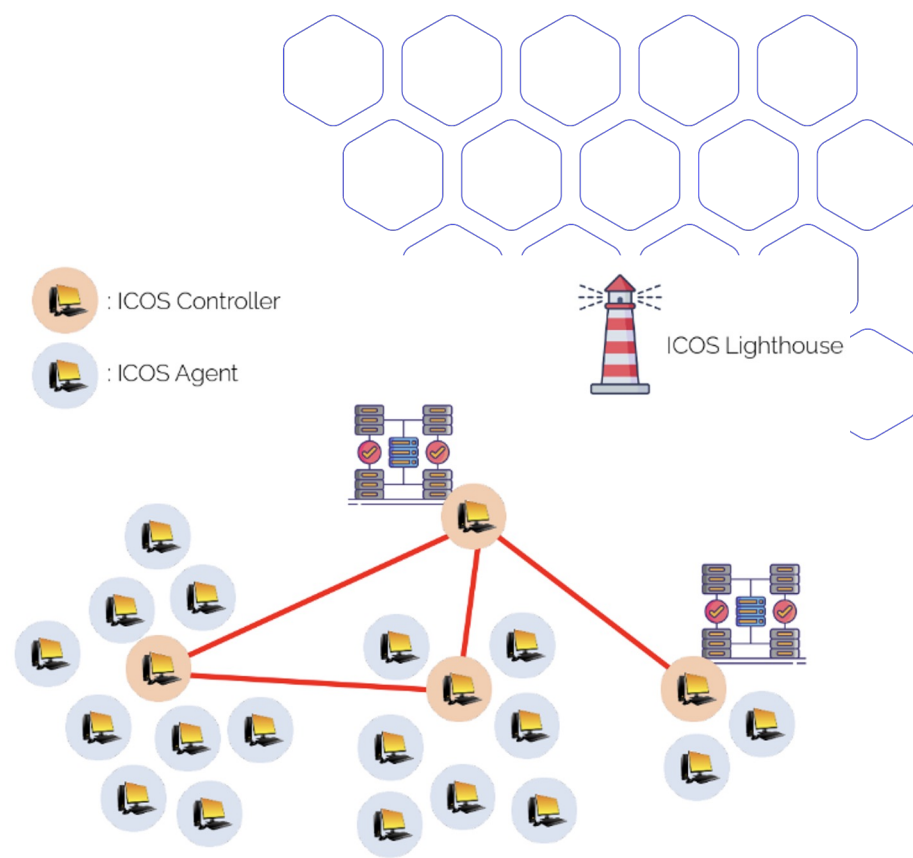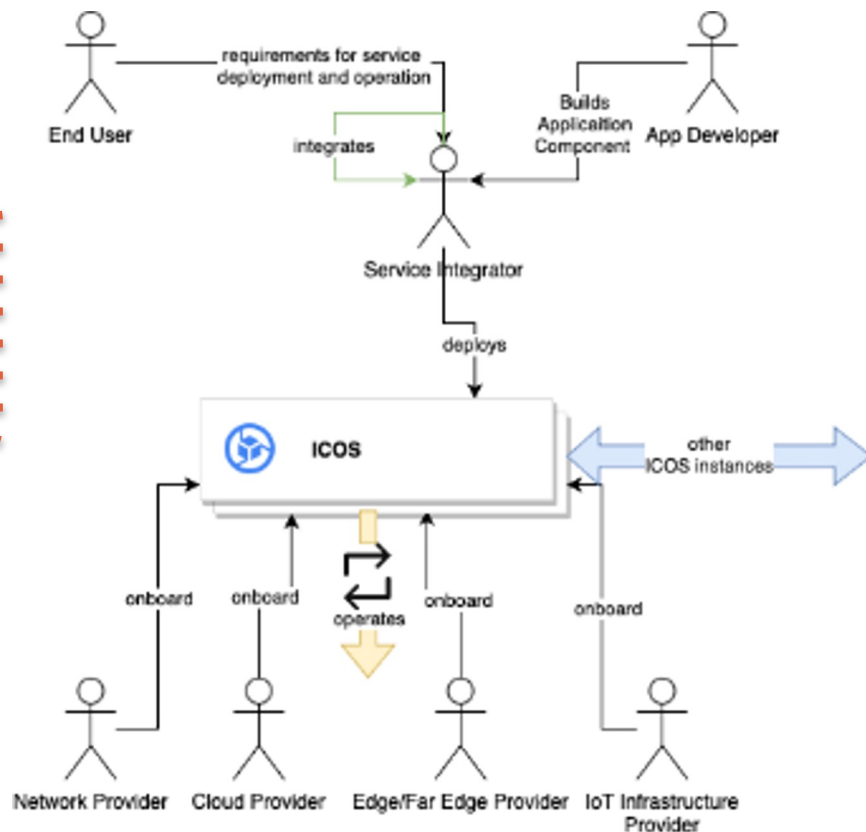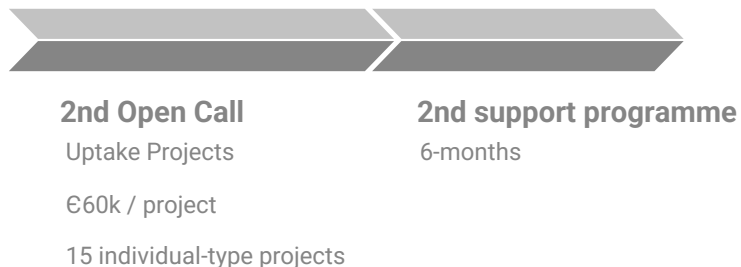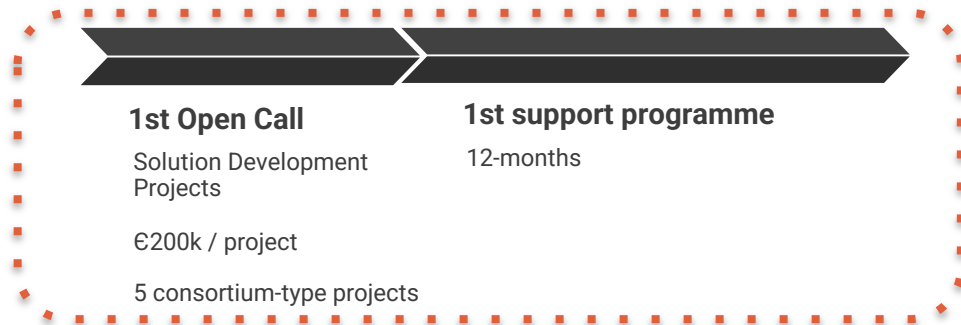
ICOS

Architecture

Conceptual architecture built on 4 functional layers:
- Distributed Meta-Kernel Layer,
- Intelligence Layer,
- Security Layer and;
- Data Management Layer
+ Additional Module - ICOS Shell

- layers are providing functionalities at node level and at continuum level
- widely distributed approach allows to decentralise the management of the continuum, reduce data transfers, ensure privacy and better exploit computational resources at the Edge without the need for a central point of control.
+ ICOS Shell, includes the user interfaces and the tools to interact with the ICOS continuum.

ICOS' funding instruments

1st Open Call

Solution Development Projects

€200k / project

5 consortium-type projects

1st support programme

12-months

2nd Open Call

Uptake Projects

€60k / project

15 individual-type projects

2nd support programme

6-months

1st Open Call

Who are we looking for? What types of activities can be funded?

Who are we looking for?

Technology Provider is any entity that is an IoT infrastructure provider, who is providing the infrastructure that will be **deployed across the ICOS continuum.**

End User is an entity that will be the end user of the deployed application.

What types of activities can be funded?

1. **Development of the proposed services**;
2. **Development of the original service**
- within an application area that is different from the project's use cases, based on the project objectives, reference architecture and components already under development

Consortium
up to €200k

Technology Provider
up to €150k

End User
up to €50k

ICOS

FundingBox
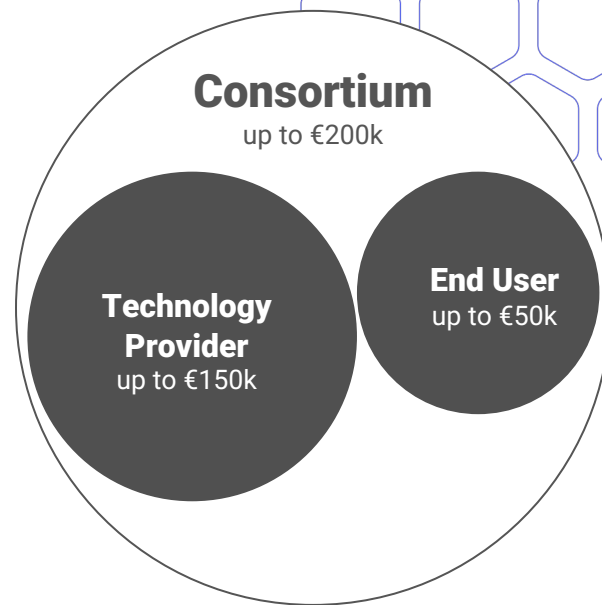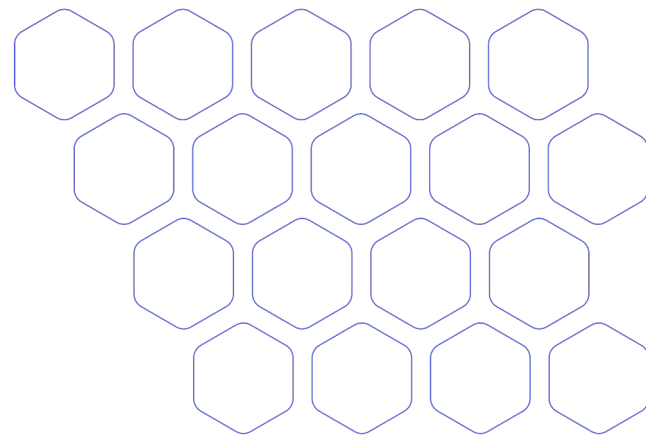
1st Open Call

Open Call end date
17 November

November

Ethics assessment(SUITE5)
Formal check (FBA)
SGA signature (FBA)

January/February

March

Evaluation of proposals

Eligibility Check (FBA)
Pre-scoring (FBA)
In/Out of Scope (SC, except FBA)
External Evaluation (Independent experts)
Consensus Meeting (SC)

1st Support Programme launch

ICOS

FundingBox

1st Open Call

Support Programme

- Mentors assigned to each beneficiary - technical partners
- The programme will last up to 12 months and consists of three stages:

Stage 1 **Requirements & Design**	**1 Month**
Stage 2 **Device level implementation of ICOS**	**5 Months**
Stage 3 **Application-scale demonstration**	**6 Months**
TOTAL	**12 Months**
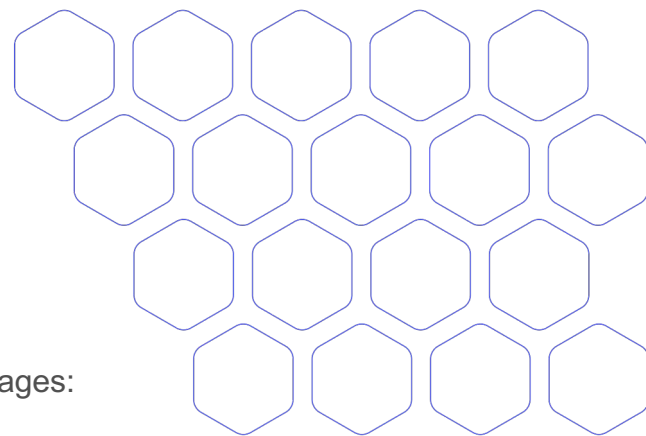
ICOS

FundingBox

Thank you for your attention.

More information:

https://www.icos-project.eu/

Questions:

icos@fundingbox.com

ICOS

FundingBox